

HOLLOW TILE

AS A

Structural Material

FOR

Building



A. LYTH & SONS CO.

48 West Eagle Street

Buffalo, N. Y.

PHONES | SENECA 109
FEDERAL 24360



INTRODUCTORY

Hollow Tile of burned clay has long been considered the standard of Fireproof construction, but as a structural member its use is of more recent origin.

It has many advantages over brick and wood in the construction of moderate-priced residences, small factories, garages, etc.

It costs very little more than wood. We figure the first cost of tile over wood construction for outside walls is about 5 per cent., but when it is considered that a frame house has to be repainted every two or three years, and that the insurance rate on tile houses is less than on frame, the difference is really in favor of tile.

It has the permanency of brick or stone. Plaster finish on metal lath or wood lath for outside work is liable to rust or rot out, leaving cracks or bad spots in the finish plaster. Tile is not affected by moisture, heat or cold.

On account of the air spaces it makes a dry wall.

It is warm in winter.

It is cool in summer.

It can be used for all structural members of a house, as walls, floors, roof and partitions, making a thoroughly fireproof house at moderate cost, or may be used in connection with wood for outside walls alone.

A. LYTH & SONS CO.

COMPARATIVE BIDS

Comparative bids on small 8-room house designed by Thorndyke & Kiessling, and estimates furnished by following contractors:

A W. F. Kearns & Company.....	Boston
B McDonald & Joslin Company.....	Boston
C P. H. Jackson	Brockton
D R. L. Donaldson	Lincoln
E J. T. Wilson & Son.....	Nahant

A separate drawing showing the details of each type of outer wall construction was prepared, and each was accompanied by a set of complete specifications for the entire house.

Everything about the house, except the outer wall construction, was identical in all nine types and may be briefly covered by the following tables:

DESCRIPTION OF VARIOUS TYPES OF OUTER WALL CONSTRUCTION

- Type No. 1—Frame covered with boards and finished with clapboards over building paper; inside surface furred, lathed and plastered.
- Type No. 2—Frame covered with boards and finished with shingles over building paper; inside surface furred, lathed and plastered.
- Type No. 3—A 10-inch brick wall, i. e., two 4-inch walls tied together with metal ties and separated by a 2-inch air space; inside surface plastered directly on the brickwork.
- Type No. 4—A 12-inch solid brick wall; inside surface furred, lathed and plastered.
- Type No. 5—Eight-inch hollow terra cotta blocks, stuccoed on the outside and plastered directly on the inside.
- Type No. 6—Six-inch hollow terra cotta blocks, finished with a 4-inch brick veneer on the outside and plastered directly on the inside.
- Type No. 7—Frame covered with boards and building paper, furred and covered with stucco on Clinton wire cloth; inside surface furred, lathed and plastered.
- Type No. 8—Frame covered with boards (building paper omitted) and finished with a 4-inch brick veneer on the outside; inside surface furred, lathed and plastered.
- Type No. 9—Frame finished on the outside with a 4-inch brick veneer tied directly to the studding (boarding omitted); inside surface furred, lathed and plastered.

DETAILS COMMON TO ALL TYPES

- A—Foundations Local stone.
- B—Cellar Floor Finished with 2-inch concrete of Portland cement.
- C—Chimney Faced with brick costing \$17.50 per M.
- D—Fireplaces Faced with brick costing \$17.50 per M.
- E—Plastering First class "two coat" work.
- F—Exterior Finish Cypress.
- G—Blinds White pine.
- H—Screens Copper bronze on white pine frames.
- I—Window Frames Hard pine.
- J—Floors Double floors throughout with paper between, except in unfinished attic; Georgia pine upper floors; main hall on first floor of oak.
- K—Inside Finish North Carolina pine.
- L—Doors Washington cedar.
- M—Hardware Bronze finish of ordinary type, costing \$60.00 for the job.
- N—Wood Mantels \$45.00 each.
- O—Conductors Copper.
- P—Flashing Tin.
- Q—Electric Fixtures Costing \$80.00.
- R—Hot Water Heating.... Costing \$250.00 complete.
- S—Wiring Costing \$68.00.
- T—Plumbing Costing \$370.00.
- U—Painting Exterior and interior; clapboard house \$225.00; other houses \$130.00.
- V—Glazing Double thick German glass.

PRICE OF MATERIALS

Lime	\$1.00 per bbl. 200 lbs.
Portland Cement	\$1.60 per bbl.
Spruce Framing	\$26.00 per M. ft. B. M.
North Carolina Pine	1c per inch per ft.
Georgia Matched Pine (first quality)	\$75.00 per M. ft. B. M.
Shingles	\$4.75 per M.
Clapboards	\$55.00 per M.
Hemlock Boarding	\$22.00 per M. ft. B. M.
6-inch Hollow Blocks	10½c per sq. ft.
8-inch Hollow Blocks	14c per sq. ft.
Face Brick	\$17.50 per M.
Common Brick	\$9.00 per M.
Allowance for Furring, Lathing and Plastering	5c per sq. ft.
Wages of bricklayers	60c per hour
Wages of carpenters	50c per hour

You may compare these figures with prices of similar material and labor in your own market, and you will then be in a position to apply a corresponding correction to the results of this investigation to make them applicable to your own neighborhood.

LUMBER DISPLACED BY BRICK ON TYPES 3, 4, 5 AND 6

Frame and Studding, 2,300 ft., B. M., at \$26 per M.	\$59.80
Square edge boards, 2,500 ft., B. M., at \$22 per M.	55.00
Spruce Clapboard, requiring for manufacture 600 ft. of stock, B. M.	93.50
Total, 5,400 ft., B. M.	\$208.30

COMPARATIVE BIDS

Type No.	1	2	3	4	5	6	7	8	9
Description	Clapboard	Shingle	10-inch Brick Wall Hollow	12-inch Brick Wall Solid	Stucco on Hollow Block	Brick Veneer on Hollow Block	Stucco on Frame	Brick Veneer on Boarding	Brick Veneer on Studding
Bid A	\$6,732.00	.....	\$7,572.00	.....	\$7,416.00	\$7,777.00	\$6,857.00	\$7,130.00	\$7,080.00
Bid B	6,235.76	6,370.40	6,736.43	7,105.00	6,491.23	6,762.83	6,410.00	6,746.20	6,664.88
Bid C	6,692.00	6,786.00	7,118.00	7,418.00	7,179.00	7,238.00	6,847.50	6,970.00	6,895.00
Bid D	6,690.00	.....	7,496.00	7,801.00	7,202.00	7,648.00	7,000.00	7,496.00	7,420.00
Bid E	7,450.00	7,450.00	7,940.00	8,240.00	7,650.00	7,990.00	7,650.00	7,790.00	7,710.00
Ave. of Bids	6,739.95	6,868.80	7,372.48	7,641.00	7,187.65	7,483.16	6,952.90	7,226.44	7,153.98

A comparison of these five bids with reference to the excess cost of the various types as compared with the clapboard house may be of interest.

EXCESS COST OF EACH TYPE OVER CLAPBOARDS

By Percentages

Bid A	100.0	.....	112.5	.....	110.2	115.5	101.9	105.9	105.2
Bid B	100.0	102.1	108.0	113.9	104.1	108.4	102.8	108.2	106.9
Bid C	100.0	101.4	106.4	110.8	107.3	108.2	102.3	104.2	103.0
Bid D	100.0	.....	112.0	116.6	107.7	114.3	104.7	112.0	110.9
Bid E	100.0	100.0	106.6	110.6	102.7	107.2	102.7	104.6	103.5
Ave. of Bids	100.0	101.6	109.1	113.0	106.3	110.7	102.9	106.9	105.8

AVERAGE OF THE TWO MOST FAVORABLE BIDS

C	\$6,692.00	\$6,786.00	\$7,118.00	\$7,418.00	\$7,179.00	\$7,238.00	\$6,847.50	\$6,970.00	\$6,895.00
E	7,450.00	7,450.00	7,940.00	8,240.00	7,650.00	7,990.00	7,650.00	7,790.00	7,710.00
Average ...	7,071.00	7,118.00	7,529.00	7,829.00	7,414.50	7,614.00	7,248.75	7,380.00	7,302.50
Excess over Clapboards .....	.....	47.00	458.00	758.00	343.50	543.00	177.75	309.00	231.50
Percentage Excess over Clapboards .....	.....	.7	6.5	10.7	5.0	7.7	2.5	4.4	3.3

COMPARATIVE COST OF HOLLOW TILE WALLS

Cost per 100 Superficial Square Feet (1 Square)

With Exterior Cement Stucco and Interior Plaster Complete		With Exterior Plain and Interior Plaster Complete		Without Exterior Stucco or Interior Plaster—Tile Keyed Ready for Plasterer	
Wall	Cost	Wall	Cost	Wall	Cost
6 in.....	\$23 85	6 in.....	\$18 35	6 in.....	\$15 50
8 in.....	27 10	8 in.....	21 60	8 in.....	18 75
10 in.....	30 85	10 in.....	25 35	10 in.....	22 50
12 in.....	32 35	12 in.....	26 85	12 in.....	24 00
15 in.....	36 35	15 in.....	30 85	15 in.....	27 00
16 in.....	39 35	16 in.....	33 85	16 in.....	29 50

PARTITION WALLS—Hollow Tile Ready for Plaster

3 in.....	\$10 50	5 in.....	\$12 80	7 in.....	\$14 50
4 in.....	11 00	6 in.....	13 10	8 in.....	17 00

HOLLOW TILE WALLS—With Exterior Brick Veneer

Cost per 100 Superficial Square Feet (1 Square)

Tile used for this purpose sometimes called "Backing up block."

Tile with keyed surfaces ready for direct application of plaster. Includes exterior stone trim.

Thickness of Wall	Face Brick Veneer	Common Brick Veneer
8 inch.....	\$38 50.....	\$26 80
10 inch.....	42 00.....	30 30
12 inch.....	45 25.....	33 55
14 inch.....	49 00.....	37 30
16 inch.....	50 50.....	38 80

SOLID BRICK WALLS—Furred and Lathed Ready for Plaster

Includes exterior stone trim.

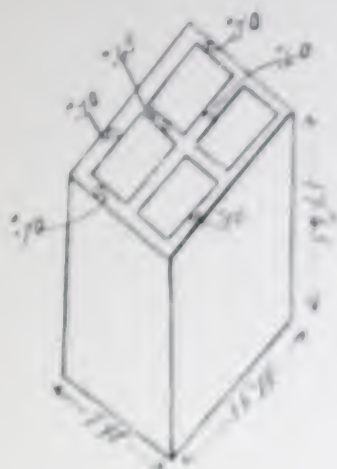
Thickness of Wall	Face Brick Exterior	Common Brick Exterior
8 inch.....	\$39 65.....	\$27 93
12 inch.....	50 45.....	38 73
16 inch.....	61 25.....	49 53

The walls, backed up with tile, have the further advantage of better insulation against heat, cold, sound and moisture, and there are no wooden furring strips and lath to warp and twist and crack the plaster and expensive decorations.

Compression Test by Ordnance Department U. S. A.

U. S. Testing Machine (Capacity 800,000 lbs.)

Watertown Arsenal, Mass.

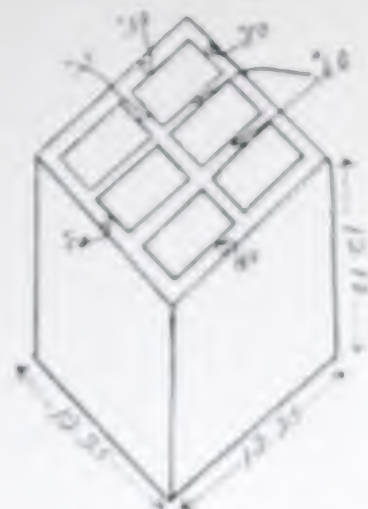


Test No. 14070, Sept. 13, 1909.

Size of Block 8" x 12" x 12"

Sectional area, net, 33.82 square inches.

Ultimate strength 122,800 lbs., or 3,428 lbs. per square inch.



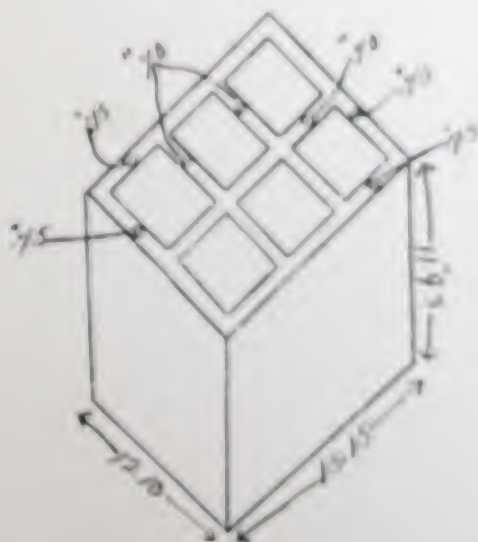
Test No. 14070, Sept. 13, 1909.

Size of Block 12" x 12" x 12"

No. 1 { Sectional area 33.46 square inches.
Ultimate strength 271,000 lbs.
8,131 " per sq. in.

No. 2 { Sectional area 33.46 square inches.
Ultimate strength 278,000 lbs.
8,311 " per sq. in.

Average 7,727 lbs. per square inch.



Size of Block 12" x 12" x 12"

Sectional area net 33.46 square inches.

First crack 278,000 lbs.

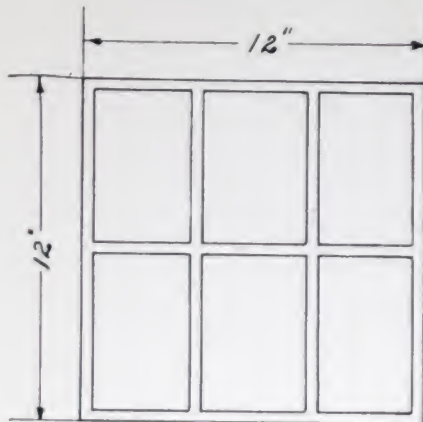
Ultimate strength 271,000 or 4,388 lbs. per square inch.

Signed, C. B. WHEELER,

Lt. Col. Ord. Dept., U. S. A.,

Commanding.

Report of Compression Tests



Columbia University, N.Y.

June 15, 1909

By IRA H. WOOLSON

Laboratory Test No. 14376

Block No. 1

12" x 12" x 12" Hollow Tile

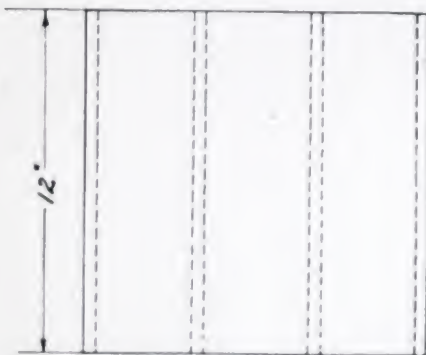
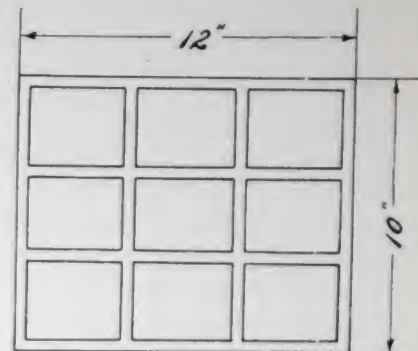
Net area sq. inches 50.46

On end

Maximum load 328,720 lbs.

Ultimate strength 6,515

lbs. per square inch



Laboratory Test No. 14377

Block No. 2

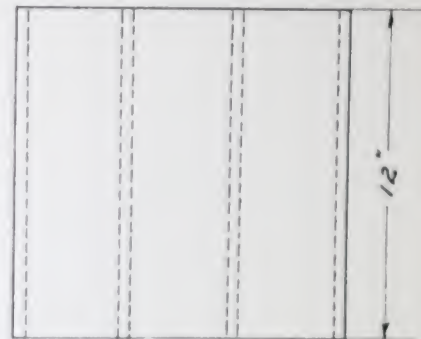
10" x 12" x 12" Hollow Tile

Net area sq. inches 53.62

Maximum load 410,670 lbs.

Ultimate strength 7,660

lbs. per square inch



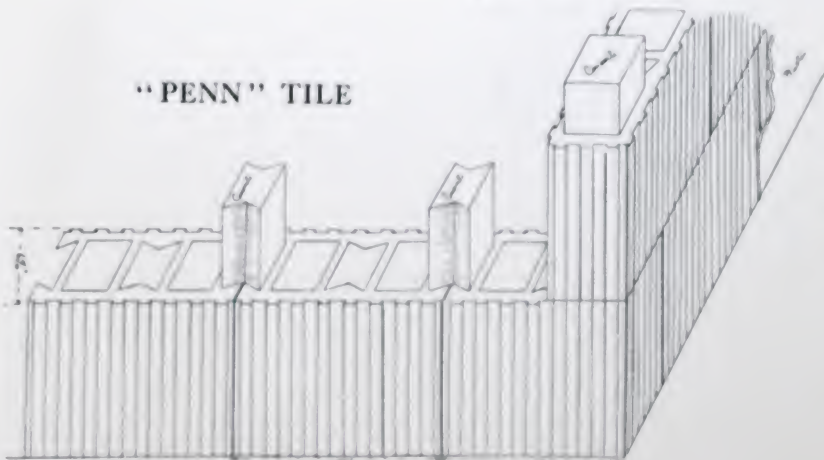
Compression Test by Institute of Technology, Boston, Mass.

Emery Testing Machine (Capacity 300,000 lbs.)

Date of Test, April 2, 1909

"Penn" Hollow Tile Block.

"PENN" TILE



Size of Block $6\frac{3}{4}$ " x 12" x 10"

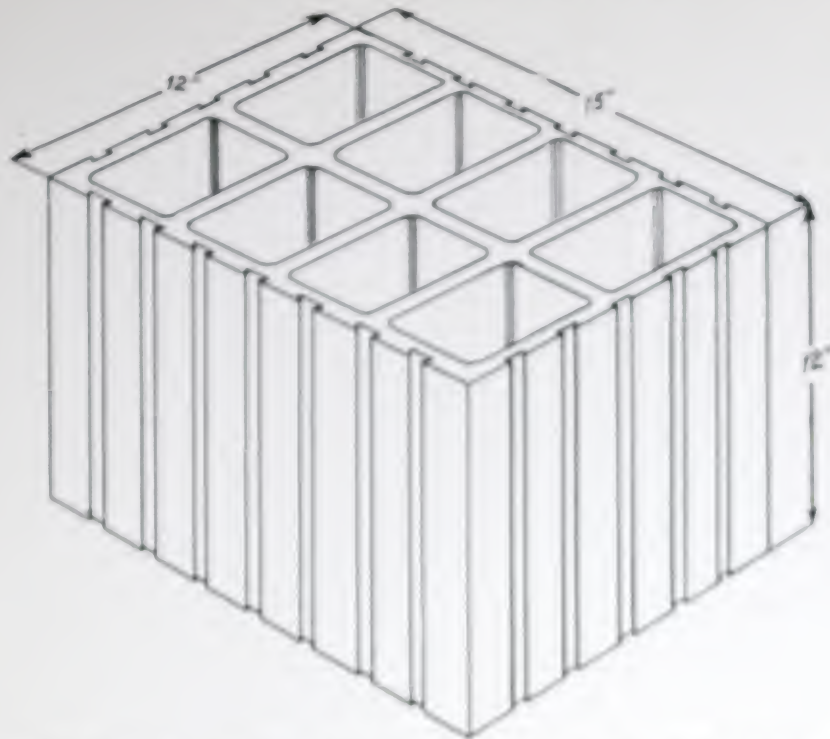
Number of blocks tested 5.

Each of the five blocks exceeded the capacity of the Emery Testing Machine, showing no cracks or flaws.

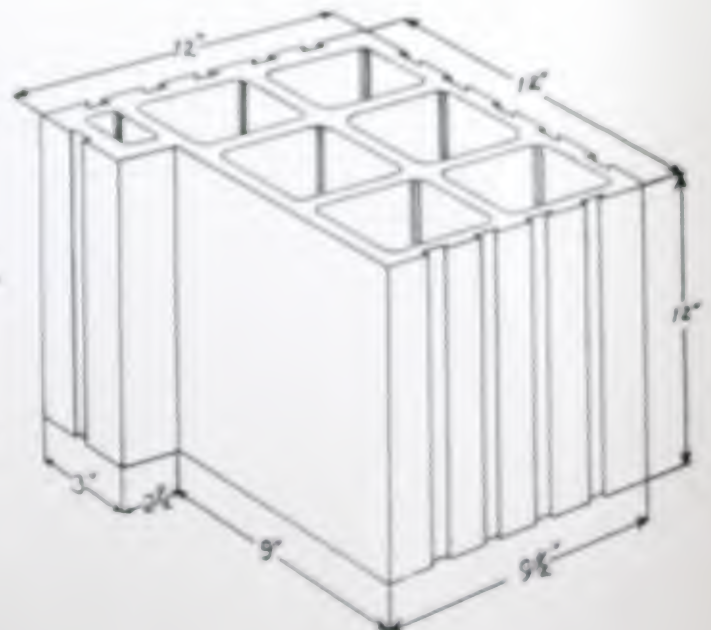
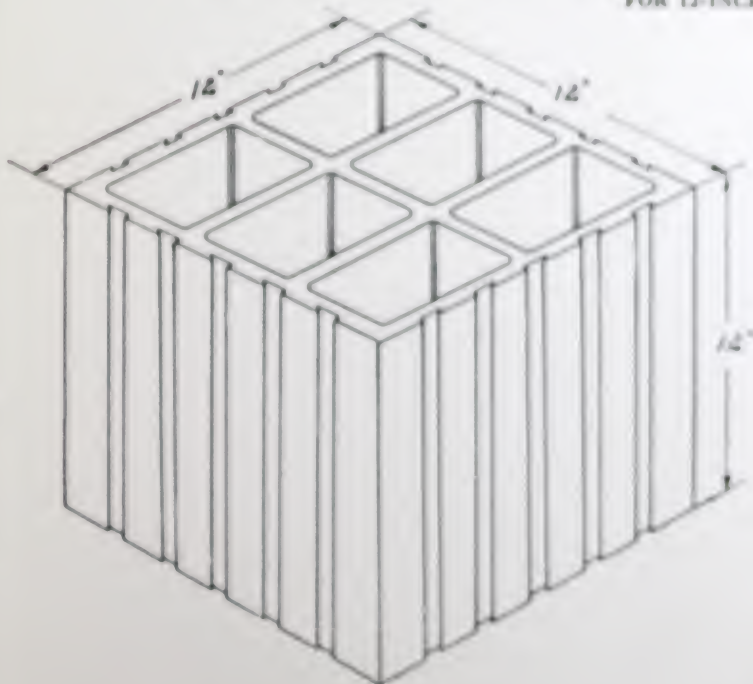
Signed,

H. W. HAYWARD.

15-INCH WALL BLOCK

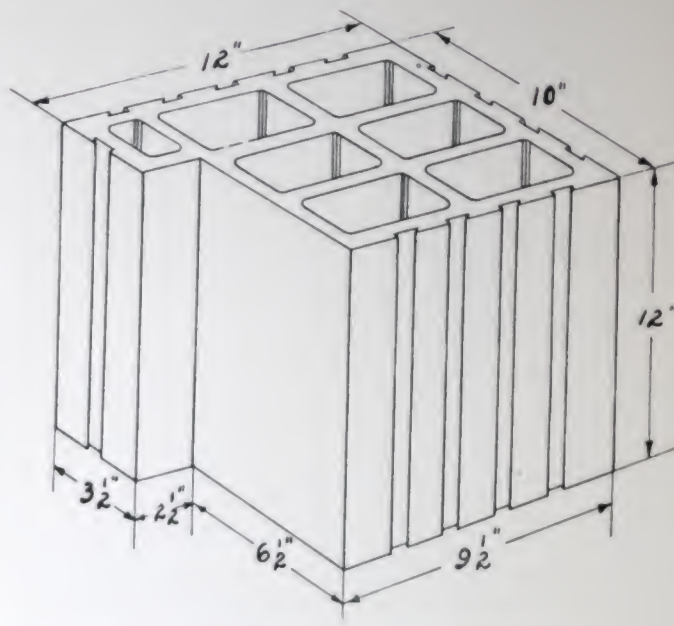
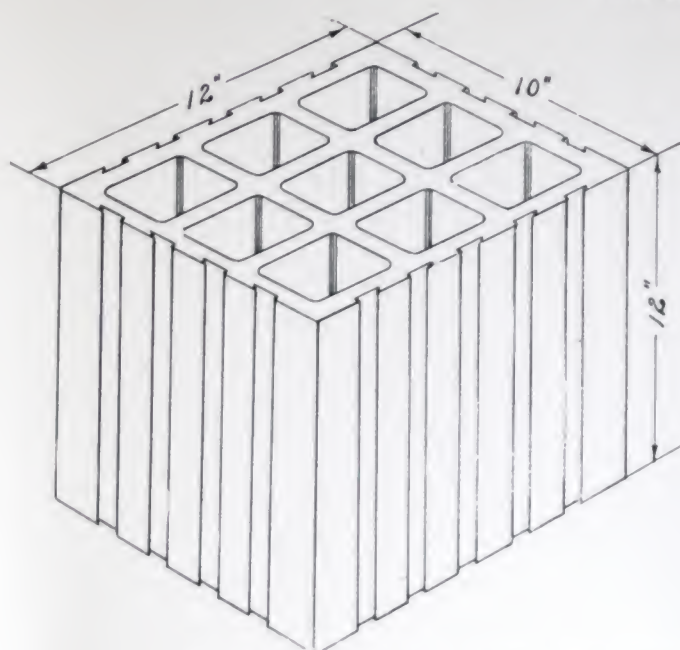


WALL BLOCK, WINDOW AND DOOR FRAME BLOCK FOR 12-INCH WALL



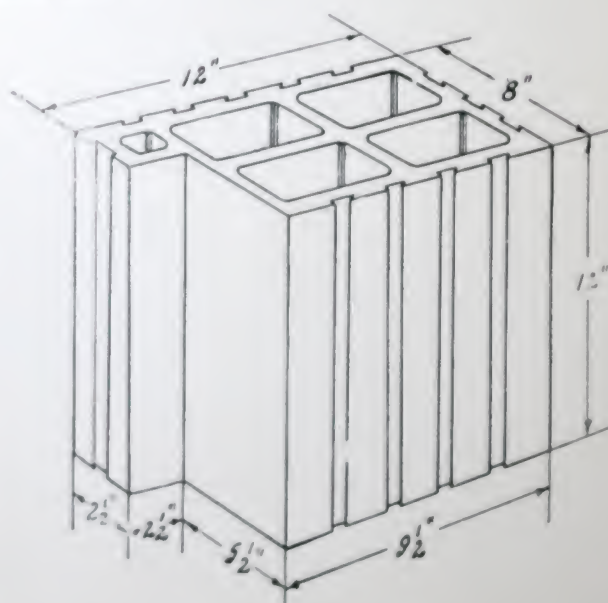
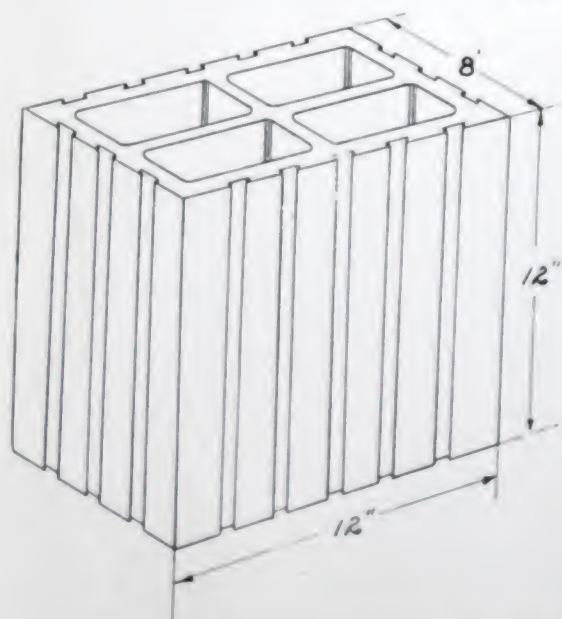
WALL BLOCK, WINDOW AND DOOR FRAME BLOCK

FOR 10-INCH WALL



Keyed faces for stucco or plaster. For lintels, stand blocks on end, fill with concrete, inserting half-inch iron rods in bottom spaces.

FOR 8-INCH WALL



Keyed faces for stucco or plaster. For lintels, stand blocks on end, fill with concrete, inserting half-inch iron rods in bottom spaces.

PARTITION TILE

Tile partitions are light, strong, easily erected by bricklayers, and do not transmit heat, cold or sound.

Three-inch partitions can be safely used up to 12 feet in height, 4-inch to 14 feet and 6-inch to 20 feet.

The Blocks are commonly made 12 inches high by 12 inches long.

Blocks should be set on end, except top course, which may be set on side. Plaster applied directly to blocks.

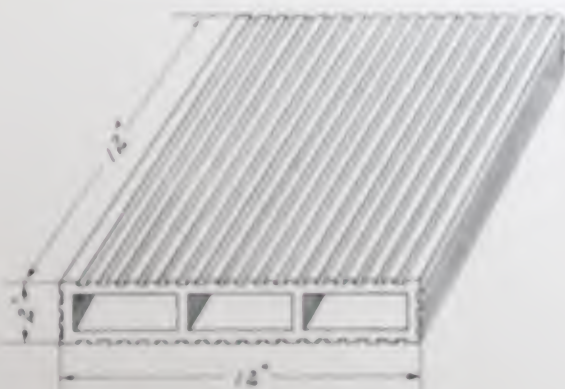


SIZE AND WEIGHT OF STANDARD BLOCKS

Size	4 x 14 x 14	Weight	12 lbs.	per square foot
3 x 12 x 12	12	12	12	12
4 x 12 x 12	16	16	16	16
5 x 12 x 12	20	20	20	20
6 x 12 x 12	24	24	24	24
7 x 12 x 12	28	28	28	28
8 x 12 x 12	32	32	32	32
9 x 12 x 12	36	36	36	36
10 x 12 x 12	40	40	40	40
11 x 12 x 12	44	44	44	44
12 x 12 x 12	48	48	48	48

WALL FURRINGS

Split furring is made either 1 1/2-inch or 2 inches thick and 12 inches square. The ribs being set against the wall, an air space is formed which effectively checks the passage of moisture. They should be set with ribs vertical and fastened to the wall by driving twenty-penny nails in the joints of the brick work, using a nail over every third block in every second course. The faces of the blocks are grooved to receive plaster.



2-inch Partition Furring

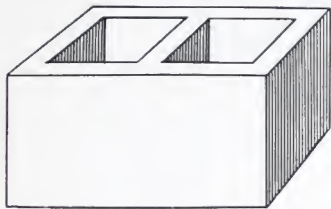
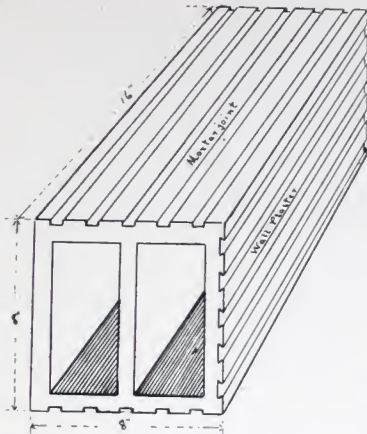
STANDARD FORMS AND WEIGHT

Size	4 x 12 x 12 Partition	Weight per square foot	12 lbs.
1 1/2 x 12 x 12 Split	8	8	8
2 x 12 x 12	16	16	16
2 x 12 x 12	11	11	11



Split Furring

HOLLOW TILE BUILDING BLOCK



Showing Corner Block.

Made in two sizes, 8 x 8 x 16 and 8 x 10 x 16, for 8-inch and 10-inch wall, respectively.

Made with plain face, rock face, or keyed to receive stucco or plaster.

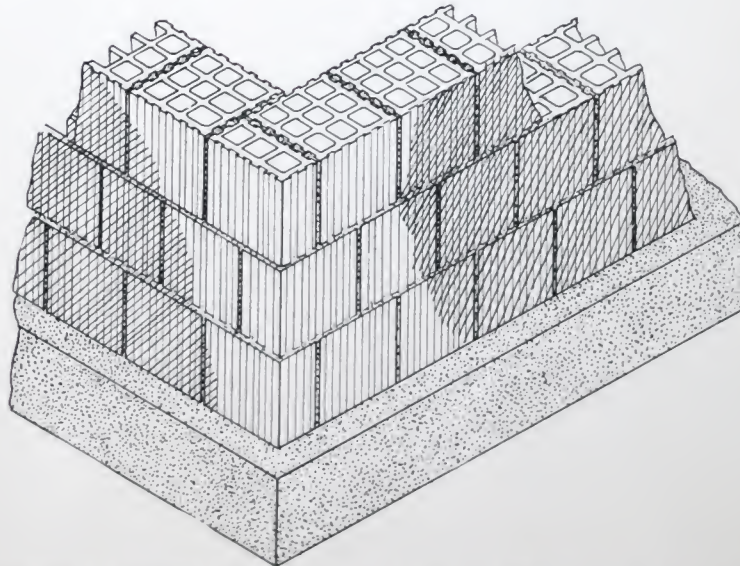
Mortar joint faces grooved so that they will lay up solid.

These blocks are vitrified, but not salt glazed. They are practically impervious to water. Color buff.

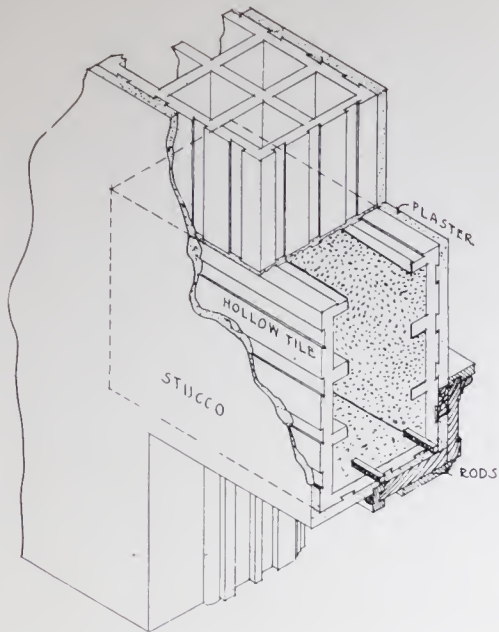
Plain face blocks used where walls are painted.



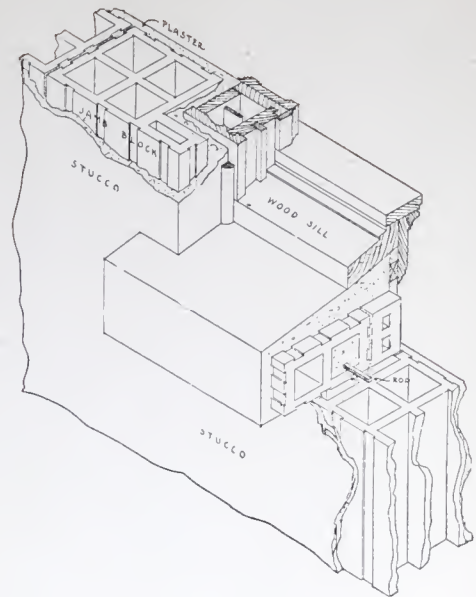
FOUNDATION



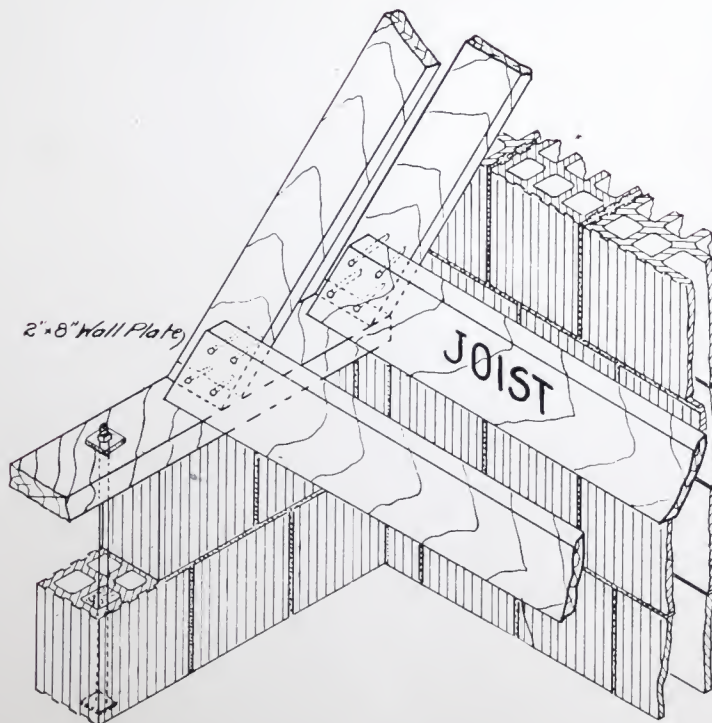
Foundation Construction, showing Concrete Footing and Waterproofing Below Grade.



Lintel Construction.

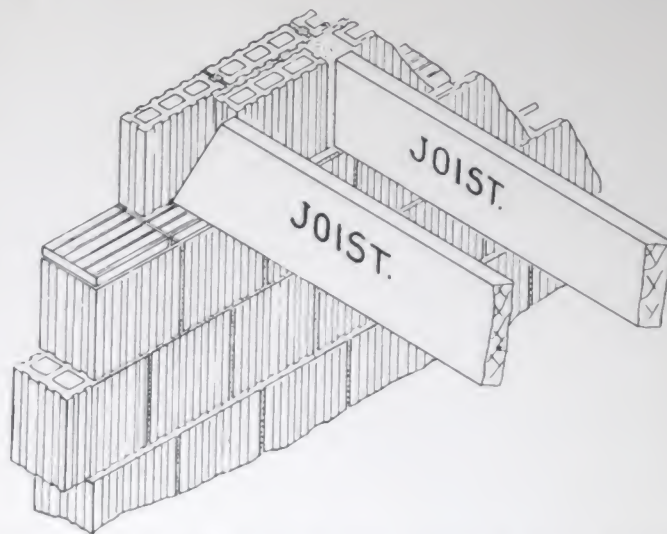


Window and Door Construction, showing
Use of Jamb Blocks.



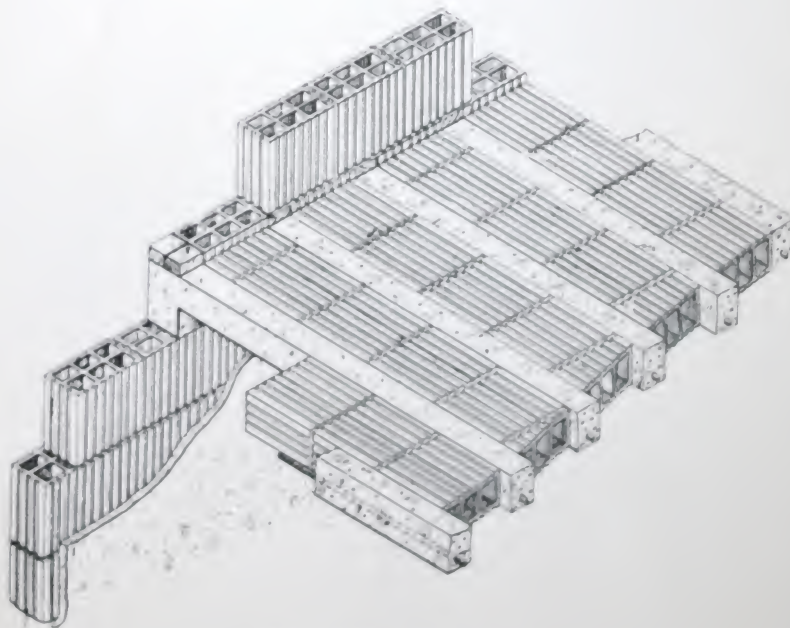
Frame Roof Construction, showing Wall Plate and Anchors.

WOOD JOIST



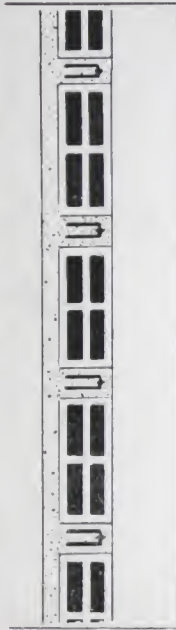
Wood Joist Construction, showing Tile Slab Under Joist, to Give a Bearing on Full Thickness of Wall.

CONCRETE JOIST



Fireproof Floor Construction.

Safe Live Loads Per Square Foot for Hollow Tile Floors of Various Thicknesses



Reinforced with $\frac{1}{2}$ " x $1\frac{1}{2}$ " Kahn Trussed Bars

Depth	4" Tile +	4" Concrete	6" Tile +	6" Concrete	8" Tile +	8" Concrete	10" Tile +	10" Concrete	12" Tile	12" Concrete	12" Tile +	12" Concrete	
	38	50	47	59	56	68	54	66	78	63	75	87	
Weight of floor in Pounds Per sq. foot													
Spacing	16" C. to C.												
SPAN IN FEET	6	378	464	565	651	752	838	852	938	1024	1039	1125	1211
	7	268	328	403	462	538	598	612	672	732	747	807	867
	8	196	239	297	340	398	442	456	499	542	557	600	643
	9	147	178	225	256	303	335	349	380	412	427	458	490
	10	112	135	173	196	235	258	272	295	319	334	357	380
	11	86	103	135	152	184	202	216	233	250	265	282	299
	12	66	78	106	118	146	159	173	185	197	212	225	237
	13	59	83	92	116	125	139	148	157	172	181	190	
	14	44	65	71	92	98	112	118	124	139	145	151	
	15	32	51	54	73	77	91	95	98	113	117	121	
	16		39	41	58	59	73	75	77	92	94	96	
	17		29	29	45	45	59	59	59	74	75	75	
	18			34	33	34	33	47	45	44	59	58	57
	19				25		36	34	32	47	45	42	
	20						28			36	33	30	
	21									27			

$$BM = \frac{wl^2}{10}$$

Reinforced with $\frac{1}{2}$ " x $1\frac{1}{2}$ " and $\frac{3}{4}$ " x $2\frac{3}{4}$ " Kahn Trussed Bars Spaced Alternately.

Depth	16" C. to C.									
	4" Tile + 2" Concrete	6" Tile + 1" Concrete	6" Tile + 2" Concrete	8" Tile + 1" Concrete	8" Tile + 2" Concrete	10" Tile + 1" Concrete	10" Tile + 2" Concrete	12" Tile + 1" Concrete	12" Tile + 2" Concrete	
Weight of floor in Pounds Per Sq. foot	50	47	59	56	68	66	78	75	87	
Spacing	16" C. to C.									
SPAN IN FEET	7	447	583	678	787	880	987	1080	1189	1282
	8	353	435	505	589	658	740	809	893	961
	9	267	334	387	454	505	571	623	690	741
	10	206	262	302	357	396	450	489	544	584
	11	163	208	239	285	316	360	391	437	467
	12	129	167	191	231	255	292	316	355	379
	13	103	135	154	188	207	239	258	291	310
	14	82	110	125	155	169	197	212	241	255
	15	64	90	101	128	138	163	174	200	211
	16		73	82	105	113	136	144	167	175
	17		60	66	87	93	113	118	139	145
	18			52	71	75	93	97	116	120
	19			41	58	61	77	79	97	99
	20			31	47	48	63	64	80	81
	21				38	37	51	51	65	65
	22				29	28	41	39	53	52
	23						32	29	42	40
	24								32	29

$$B.M. = \frac{wl^2}{10}$$

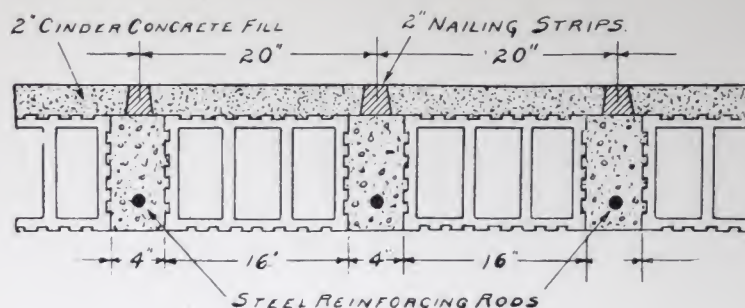


Fig. 1.

Safe Live Load in Pounds per Sq. Ft. Factor of Safety--4.

Span in feet.	4-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —26 lbs.	5-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —30 lbs.	6-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —38 lbs.	7-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —43 lbs.	8-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —48 lbs.	9-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —57 lbs.	10-in. Tile $\frac{3}{8}$ -in. Rod Weight of Floor Per sq. ft. —58 lbs.	12-in. Tile 1-in. Rod Weight of Floor Per sq. ft. —68 lbs.
7	137	230	334	456	680	796	962	247
8	99	168	248	338	509	596	725	941
9	73	127	188	258	392	461	559	729
10	54	97	145	202	308	363	442	577
11	40	75	113	158	227	291	355	466
12		58	89	126	199	236	289	379
13		45	70	101	163	193	238	313
14			56	80	134	160	197	261
15			43	65	110	132	164	218
16				48	91	110	137	184
17					75	92	115	155
18					62	76	96	131
19					51	63	81	111
20								93

The above loads are for the tile and concrete beams without the 2" concrete fill on top.

If 2" concrete top is used, with wood sleepers for nailing floors (See Fig. 1) the floors will carry fully twice the load shown in table.

The above load Table can be used for floor arch as illustrated in Fig. 2, provided the diameter of steel rods is increased 1-4" in each floor dimension.

Composition of Concrete:—One part cement,
Two parts sand,
Four parts stone or gravel.

Working strength of Steel:—16,000 lbs. per square inch.

8-INCH SIDE CONSTRUCTION ARCH

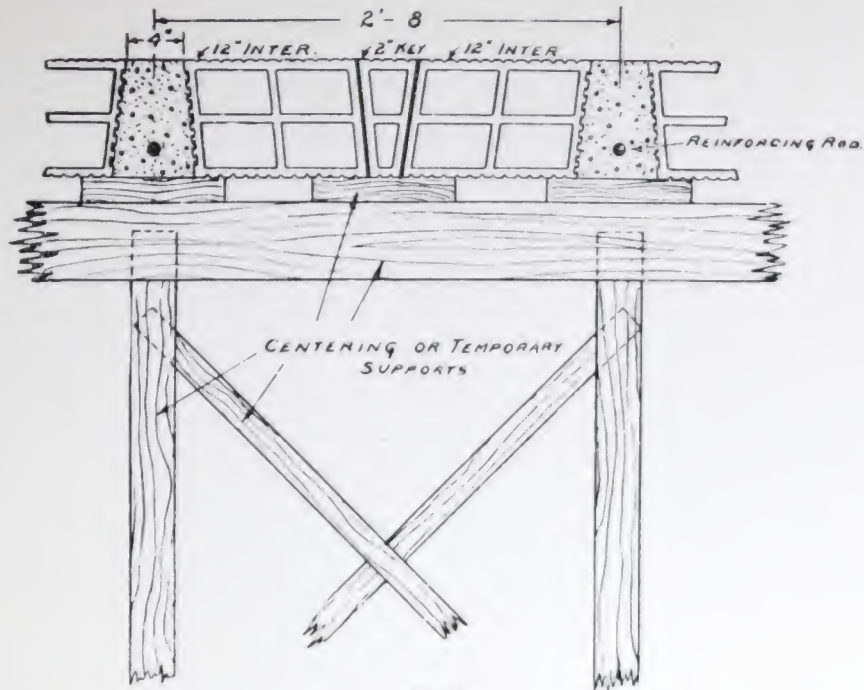


Fig. 2

HOLLOW TILE FLOOR BLOCK

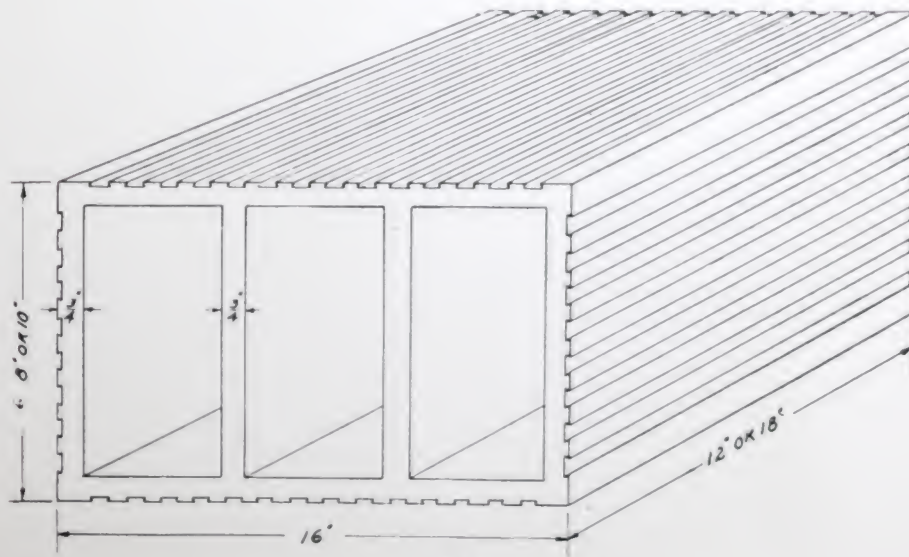
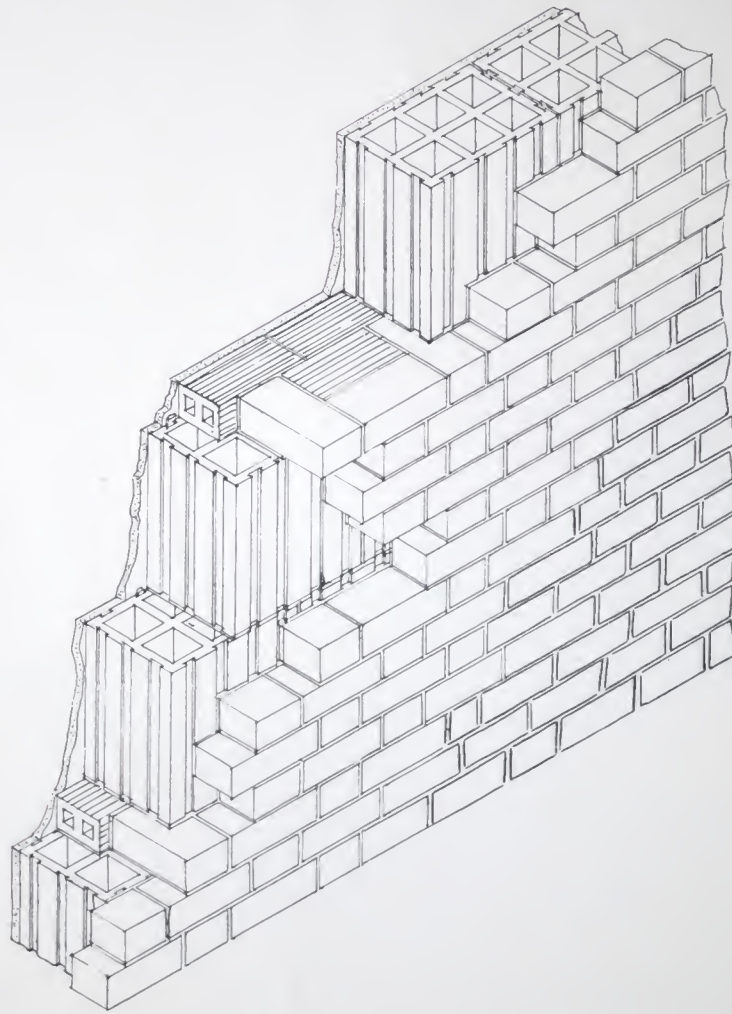


Fig. 3

Hollow Tile Floor Block, to be Used in Connection with Concrete Supporting Beam.

BRICK VENEER WALL



Brick Veneer Wall. Can be Used with 4-inch, 6-inch, 8-inch or 12-inch Tile.



RESIDENCE FOR JAMES H. DYETT

Robert North, Architect

Hollow Tile Walls and Partitions, Columns and Floors Reinforced Hollow Tile.



Mr. James H. Dyett's Residence in Course of Construction



THE WM. HENGERER CO.

C. K. Porter & Sons, Architects

Three Top Stories : 8 inch Hollow Tile, Backed Up with 4-inch Hollow Tile.



GARAGE FOR WM. M. DECKER, M. D.



KENMORE HIGH SCHOOL

Large & Rowland, Contractors. Robert North, Architect.

Wall Hollow Tile, with Brick Veneer, Partition Hollow Tile, Floors and Columns Reinforced Hollow Tile.



GARDEN WALLS OF HOLLOW TILE

Owner, W. J. Statler. Architects, Townsend & Fleming.



RESIDENCE OF MICHAEL COSTANZO

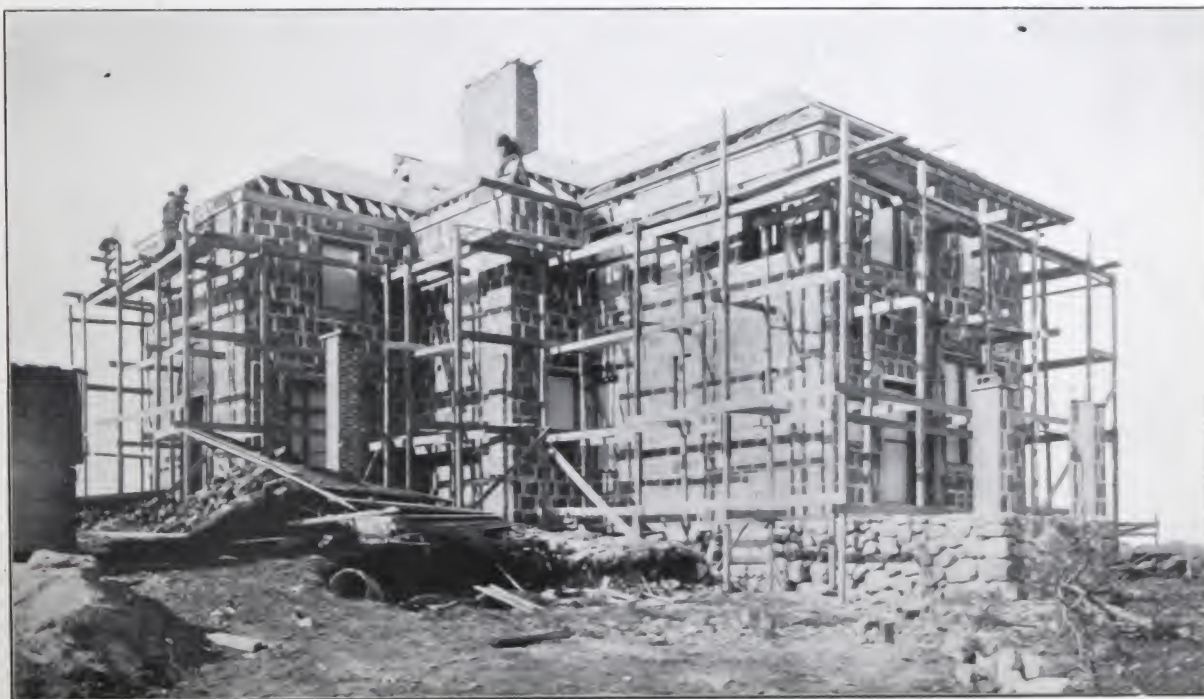


HOLLOW TILE HOUSE AND STABLE, A. LYTH & SONS CO.



RESIDENCE AT BROOKLINE, MASS.

Henry F. Keyes, Architect.
Hollow "Penn" Tile.



RESIDENCE AT WAYLAND, MASS.

G. Henri Desmond, Architect.
"How It's Done."



GARAGE

C. Paxton Cody, Architect, Erie, Pa.

First Story, Plain Hollow Tile Building Block. Second Story, Keyed Hollow Tile Building Block with Stucco.



A COUNTRY HOME—OWNER'S RESIDENCE, GARAGE, BARN AND FARMER'S HOUSE

C. Paxton Cody, Architect, Erie, Pa.

Hollow Tile Throughout.



UNITED STATES BRAKE SHOE CO.'S FOUNDRY AT CORRY, PA. (In course of construction.)

Hollow Tile Walls, Concrete Pilaster with Rabbet to receive Tile Curtain Walls.



THREE MODERN TILE HOUSES

Stucco Exterior and Slate Roofs, Porches, Columns and Steps Tile and Cement.

A. LYTH & SONS Co.

DEALERS IN

BUILDERS' SUPPLIES

Sewer Pipe	Hollow Tile
Flue Linings	Building Blocks
Fire Clay Stove Pipe	Wall Coping
Fire Brick	Metal Lath
Fire Clay	Insulite Water-Proofing
Drain Tile	Hollow Brick
Portland Cement	Chimney Tops
Lime	Mortar Color
Plaster	Roof Tile



